Sandia National Laboratories

MFG S&T Quarterly

MFG Science & Technology That Makes a Difference

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Rapid Manufacture of Targets

The Manufacturing Enterprise recently teamed with the Organic Materials Department to successfully fabricate, bond, and post trim flight and ground test hardware in support of the nation's needs in reentry, aerospace, precision guidance, and target acquisition technologies for the Lethality and Threat and Targets Department. One particular project required the fabrication of several targets for sled track testing of the Exo-atmospheric Kill Vehicle (EKV) for the Missile Defense Agency's Ground-based Midcourse Defense program for the United States Army Space and Strategic Missile Defense Command of Huntsville Alabama. These tests are part of the Live Fire Test and Evaluation (LFT&E) program to assess the lethality of the EKV system. LFT&E is a process that must be completed prior to acquisition of a weapon system by the United States Government. Data from these tests are used to validate computer simulation of the EKV performance.

The fabrication team was responsible for fabrication of large, geometrically complex substructures to meet an accelerated delivery schedule. This is a multi-step, complex process that requires exceptional coordination among the various team members and departments. The process starts by machining a large aluminum substructure (this process alone takes upwards of 300 hours of machine time) in building 840 from a solid billet and procuring a phenolic heat shield through Manufacturing Liaison. Next, the Plastics Lab does surface preparation on both parts then delivers them to building 963 for a dry fit and bonding. The Plastics Lab then performs the oven cure in building 878 and the bonded parts are returned back to building 840 for final post trim machining.

Gregg Jones working on substructure project

Compressed test schedules and continually changing test requirements demand high flexibility during design and fabrication phases to meet deliverable timelines. Manufacturing Enterprise (ME) personnel responded to this challenge by:

- defining new manufacturing strategies which included the creation of innovative fixturing to resolve tolerance issues and fabrication difficulties of large diameter, thin walled aluminum substructures,
- developing techniques to acquire in-process mechanical measurement data using a portable coordinate measurement system,
- consultations with metallurgists to understand and define manufacturing strategies to minimize residual stresses in the material caused by heat treatment and machining.

To meet the customer's delivery requirements, Machinist Tradesmen teamed and worked extended non-standard schedules allowing mission critical computer numeri-

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Mfg S&T Center Restructured for Future Growth

The Mfg S & T Center has been restructured so that it will be easier to maintain and grow its strengths as a customer-focused organization. In an interview the Center Director, Gil Herrera, explained his rationale and short and long term goals for the reorganized Center, as well as future construction plans.

Herrera emphasized that he was "incredibly impressed with the teamwork, interaction with customers, and professionalism of everyone I've met. The restructuring is designed to exploit and build upon these strengths."

Herrera noted that, "The Center thrives because of our very positive relationships with customers. We go beyond requirements for manufacturing parts to share our knowledge and expertise in all aspects of their business. Our customers have gained tremendous value when we've integrated our efforts across our organization."

Citing the Center's work on targets for the Missile Defense Agency and a sensor for a satellite customer as examples of successful projects, Herrera explained, "There are many other opportunities for our integrated solutions. We're seeking out larger, more value-added projects, and increased opportunities to help customers by providing integrated solutions."

As a result of the restructuring, the Center now has two Level II managers.

Consistent with the direction provided by the Nuclear Weapons SMU, each Level II manager will have operational responsibility for achieving Center goals and objectives. One will oversee the Manufacturing Enterprise, including our mechanical manufacturing operations and the development of emerging manufacturing technologies and associated science and technology. This new structure will facilitate the utilization of these new technologies for our customers. The other operational deputy will oversee Manufacturing Process Science and Technology. Carol Adkins will be the Deputy Director of Manufacturing Process Science and

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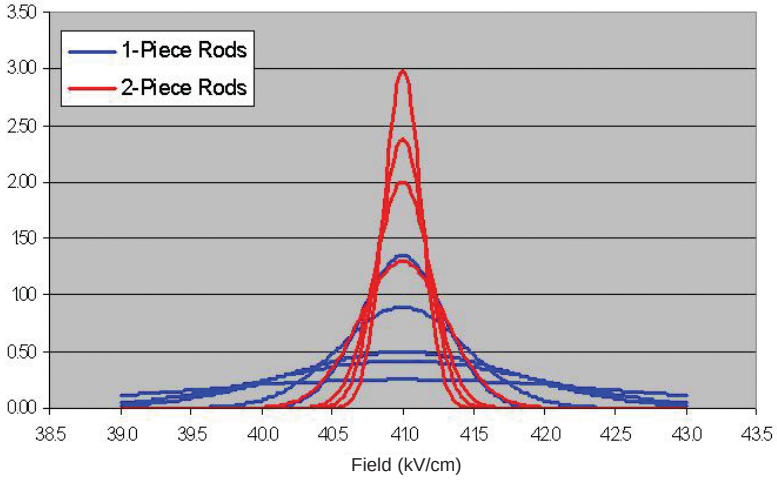
Tech Updates

Voltage Distribution Improved with Split Rod

Neutron generator reliability is heavily dependent on its power supply components, all of which are manufactured in the Mfg S&T Center. The voltage regulator (rod), manufactured in the Ceramics and Glass Department, has a significant effect on neutron generator output. Although over 50 WR lots of rods have been delivered to date, all meeting voltage distribution specifications, improving that distribution could lead to increased long term reliability.

Utilizing the relationship that the rod switching voltage is directly proportional to its length, a new design has been implemented that improves the voltage distribution significantly. If one could pair up the high and low values from a normally distributed population, the resulting distribution would have the same mean, but a markedly tighter distribution. By fabricating half-length rods, determining their voltage distribution, pairing the high and low outputs, and then joining them in a single assembly, it should be possible to realize a tighter distribution.

Comparision of Voltage Distribution for 1-piece and 2-piece rods



Although the concept is straightforward, its implementation presented several challenges. To realize the improvement, the switching voltage of the half-rods must be reproducible in the assembled two-piece component. The additional fabrication steps to produce the two-piece rods must not add additional variability which could cancel the improvement in distribution made by pairing. New testing and assembly fixtures (designed and built by K. Morris and M. Saavedra) and techniques (M. Romero) were developed to ensure alignment of the two-piece assembly, critical for final grinding procedures and eliminating potential high voltage breakdown producing edges.

Four prototype two-piece rod lots have been fabricated and their voltage distribution is compared to standard one-piece rods in the figure below. The two-piece rod distribution has fully met expectations, with the widest two-piece distribution equivalent to the best one-piece distribution. Upgrading the fixturing for production is in process. Deliveries of two-piece rods have been made for final development builds.

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Mfg. S&T Center Restructured for Future Growth

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Technology, and Joe Harris the Deputy Director of the Manufacturing Enterprise.

The Manufacturing Enterprise includes a new organization, the Manufacturing Engineering and Process Development department. This department will work on advanced mechanical manufacturing technologies, and help bridge the gap between research and manufacturing. Because of the critical role of information technology in manufacturing, information technology is considered an advanced manufacturing technology area in the new department. Gil Benavides is the acting manager of this new department.

Herrera also seeks to facilitate partnerships between the Manufacturing Enterprise and Manufacturing Process Science and Technology. “We need to be able to help our customers decide when one or more of our advanced methods or processes should go into volume production and when they should not. We can be more proactive in developing processes for customers.” Herrera cited high-speed machining as a good example, but foresaw more in the future, especially in the rapid prototyping area. “Our goal is to have the shop floor linked to research and development within the center.”

Herrera also noted that, “To progress, we need to understand the work of our colleagues internally so we can address the cross-disciplinary needs of our customers. We can use our strengths in materials science, for example, to help customers understand the benefits of advanced brazing and adhesion technology as opposed to traditional joining technology. As we earn trust and respect for the breadth and depth of our knowledge, we are more likely to become involved in the early design requirements stage rather than further down the track. Our customers need our insights early. This will lower costs, improve delivery to schedule, and improve the quality of our work.”

Herrera recognized that the Center’s financial system needs some changes and is exploring options that will align the system with the nature of the Center’s work rather than by internal organizations. “The goal is a financial system that meets all corporate requirements and encourages teaming. We would also like to facilitate the participation of center employees in LDRD projects by having an LDRD rate that makes us cost at rates proportional to other centers.”

Construction to Address Space Issues And Expand Capacity

Herrera also discussed two building projects that should alleviate space issues within the next 18 months. The first is the construction of a General Plant Project (GPP) building, to be built between building 752 and the T-Bird Café. In addition to office space, the GPP could also include light laboratories. It will be shared with Center 2600.

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cal controlled machines to run multiple shifts for thirteen months. This project relied heavily on numerous capabilities within the Manufacturing Sciences & Technologies Center, including Heavy Machining, Manufacturing Liaison, NC programming, Mechanical Measurements, Precision Metals Forming and the Plastics Laboratory. Dedication and shared responsibility enabled the delivery of all substructures on schedule.

By successfully completing this high consequence multi-step fabrication project, the ME has enabled its customer to meet delivery schedule commitments, which will help meet the nation's defense initiatives. In addition, this team's effort has helped forge a stronger relationship between the Manufacturing, Science and Technologies Center and the Aerospace Systems Development Center. The ME has demonstrated manufacturing expertise and agility by rapidly responding to its customers needs which will promote future partnerships.

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The second project is to expand our capacity to build ceramic components for neutron generators. This will involve significant changes to the existing ceramic processing facilities in building 878 and expansion into surrounding areas. Space problems resulting from this expansion is the reason the GPP building is being constructed. Kathleen McCaughey's Manufacturing Systems S&T program is funding both construction activities.

Another facilities change is the decision to bring the majority of the Advanced Manufacturing Processes Laboratory (Building 878) into the limited area. We are making this change to better meet our customers' needs and to alleviate security concerns identified during the security stand down last year. Planning for this change is underway, and we expect to make the change sometime this Fall."The restructuring, new construction, and move into the limited area will all help our Center improve our products and services for our customers."

Micro-Mill and Diamond Turning Center

Michael Saavedra performing diamond turning operation

The Manufacturing, Engineering and Process Development Department recently acquired a new high precision machining capability. The Moore Nanotechnology 350FG is the new four axis ultra-precision lathe/mill. The four axis operation allows for orientation in the x, y, z and spindle orientation (c axis) directions. The turning center can machine parts up to 14 inches in diameter and 12 inches in length. Material can be processed with either spherical or aspherical turning with a motion accuracy of less than 50 nanometers (nm). Surface finish quality of better than 4 nm accuracy can be achieved. The Moore 350FG spindle runs at a speed of between 0 and 2000 rpm. Positioning accuracy of ± 12 arc seconds is achievable with a positioning repeatability of 0.5 arc second. The X, Y and Z axes are run with brushless linear motors. Oil hydraulic bearings are used for all axes. The cutting tools used by the mill are fabricated from single crystal diamonds. This allows for extremely precise cutting surfaces as compared to other types of material typically used in cutting tools. This is due to the specific desirable properties of diamond for this particular application.

The new lathe/mill was qualified by producing an optical quality finish on a 75 millimeter

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Insider News

The ME Implements Enterprise Resource Planning

The Manufacturing Enterprise (ME) is implementing Enterprise Resource Planning (ERP). The ERP software, JobBOSS, is more than a tool—it's a way of life. JobBOSS adds a full range of job scheduling, material management, job tracking, and quality capabilities to the shops. By implementing JobBOSS, the ME can provide its customers with realistic delivery dates; manufacturing employees can expect a more even distribution of the workload; and estimators can easily use past manufacturing processes and times to add precision to current estimates.

The goals are customer focused. JobBOSS is helping the ME track and schedule projects, piece parts, and complex assemblies. The estimated manufacturing times of components can be scheduled sequentially or in parallel. QC-1 and other high rigor, procedure-driven manufacturing processes can be detailed, recorded, and documented with the software. JobBOSS can provide customers with details about the manufacturing process, precise manufacturing times, and individual component costs. Customers will have the ability to furnish precise answers to their sponsors' inquiries.

JobBOSS implementation is expected to take about one year. Approximately 80% of the ME's manufacturing employees have been introduced to the ERP software. The remaining employees will be trained before summer's end. A customer portal will be activated after all areas inside of the ME have successfully implemented the JobBOSS scheduling and job tracking modules.

The customer's portal is a web-based application. The ME's customers can note the status of their current projects from any PC that has access to Sandia's Intranet. As an example, they can verify quantities ordered, expected delivery dates, and they can easily identify the shop within the ME that is producing their hardware. A January 2005 rollout of the customers' portal is anticipated.

In the end, it will be a union of off-the-shelf and customized software. The ME's information technology support personnel are designing a timecard. Employees will make daily entries. The custom program will transfer the daily JobBOSS time entries into Sandia's web-based timecard. It's a user-friendly method of recording daily progress.

The Manufacturing Enterprise believes that the implementation of this enterprise resource planning software is another positive step towards the achievement of "Excellence In The Customer's Interest."

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Model-Based Product Acceptance Team Wins Gold President's Quality Award

The Model-Based Product Acceptance (MBPA)Team was awarded a Gold President's Quality Award. Now in its eleventh year, the Awards program thoroughly examines many aspects of a program's commitment to and processes for achieving and continuously improving the quality of work. This includes mission and scope of work; program management for assurance that responsibilities, risks, tasks and deadlines are met; human resources management; recognition of achievements and programs for personal development; management of costs for an effective and efficient program; and the development and evaluation of processes for customer satisfaction and improved efficiency.

Sandia team members were Douglas G. Abrams, Ronnie L. Albers, Maureen R. Baca, Edwin A. Bryce, Patricia A. Barthelmes, Jo D. Bridge, Peter Chauvet, Perry J. Cowen, Gary M. Gallegos, Monico A. Lucero, William R. Nance, James H. Paustian, Jane M. Poppenger, Ray A. Sanchez, Terrance T. Smith, Lee Rieger, Daniel G. Pellegrino, Larry Varoz, and Jamie L. Welles.

External team members were Gary Eckert, Louis R. Perez and Rick L. Pierson (DOE/AL), and Jim Reilly, Don Schilling, Don Rathburn, and Lisa Vernon, (KCP).

Stephen S. Baca was the team leader.

The team was previously awarded a 2002 NNSA Weapons Award for Excellence for producing the first-ever, model-based, mark-quality weapon products accepted by NNSA.

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Mfg S&T Individual and Team Employee Recognition Awards

Two individuals and the Target Hardware Fabrication Team, as well as Center members working in other Division teams, were honored with Employee Recognition Awards.

Kenneth A. Peterson of the Thin Film, Vacuum and Packaging group won an ERA for Individual Technical Excellence and **Rosalinda Vargas** of the Electronic Fabrication Team won for Individual Exceptional Service.

The Target Hardware Fabrication Team members were Daryl E. Reckaway. John L. Dunton, James R. Pankey, Terrance T. Smith, Jose O. Barela, Anthony F. Gomez, Herman L. Molina, Jack D. Heister, Mark A. Kumpunen, Kraig R. McKee, Johnny W. Montano, Ronald A. Sorley, Mark P. Forster, Gregg K. Jones, Richard D. Miller, Joseph N. Nekoranec, David E. Rogers, Henry R. Romero, Clarence. Sanchez, Fred L. Sanchez, Robert C. Vargas, Michael A. Vining, Francisco M.Carrillo, Glen L. Heston, Henry R. Romero, Antonio J. Zamora, Ronnie L. Albers, Robert Sierra, Henry G. Baca, Roy K. Bonsack, John P. Cresap, Donald R. Greene, Thomas H. Kaufmann, Michael E. Mcreaken, Daniel M. Sena, William T. Vanselous, Tracy L. Jaramillo, Lin Nguyen, Rosalinda Vargas, David A. Calkins, Glendon C. Clark, Ernest A. Correa, Rex K.Jaramillo, Johnson Morgan, Jason N. Tillotson and, from Aerospace Systems Development, Bruce P. Page

Mfg S&T Center Employees on other Division Teams included:

BV+ Guidance and Control

Donald W. Davis, Louis A. Gonzales, and William B. Hughes

Project GENIE (GENeric In-situ Emplacement)

David L. Zamora

The MC4652 Crypto Coded Switch

Mathew W. Donnelly and Fernando Uribe

Purchased Material Acceptance Application Implementation

Monico A. Lucero

MC4277 Neutron Tube Ion Source

Ronald S. Goeke

SwitchTube Group

Ray E. Peter

MC4277 Brazed-Subassemblies Process Improvements

Edwin A. Bryce

BDYE Sensor Development Team

Edward J. Barreras, Julia L. Blocker, Marlene E. Chavez, Ronald S. Goeke, Kerry Lamppa, Guy E. Prevost, Beverly L. Silva, Allison Tafoya, and Fernando Uribe

Pollution Prevention (P2) Staff and Line Partners

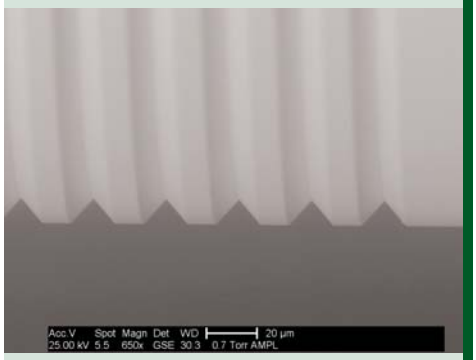
Corey B. Campbell and John L. Zich

Congratulations to all!

Sandia is a multiprogram laboratory operated by Sandia Corporation, a Lockheed Martin Company, for the United States Department of Energy's National Nuclear Security Administration under contract DE-AC04-94AL85000. SAND2004-2344P

Micro-Mill, (Continued from page 3)

(mm) aluminum disk machined to a 250mm convex spherical radius. Therefore the machining produced a convex aluminum mirror surface. The form error was better than 98 nm and the surface roughness better than 3.1 nm.



A microphotograph of the finish on a Monel (copper-nickle) part. The scale denotes 20µm

An optical quality surface should have accuracy better than the wavelength of visible light. The shortest visible wavelength is about 400 nm. Therefore the milled surface is a very good mirror in all regions of the visible electromagnetic spectrum. The surface will also focus energy from waves with ultraviolet wavelengths. The ultraviolet region of the spectrum extends from about 400 nm down to around 10 nm. The qualification was completed using aluminum but copper, nickel, brass, germanium, zinc sulfide, zinc selenide, silicon and acrylic can also be machined to an optical finish.

Several high precision machining projects have been completed for a variety of customers.

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SkillsUSA

For the sixth consecutive year, Sandia will be represented in the National SkillsUSA (formerly known as VICA) Machine Tool Technology competition. Two student interns, Peter Michel and Nathan Debuck competed in the TVI in-house competition with Debuck placing first and Michel second. The results switched at the state contest in April with Michel finishing in first and Debuck in second. In June, Michel will be traveling to Kansas City, Missouri for the national competition where he will be up against other students from all around the country.

SkillsUSA is a national organization serving a quarter-million high school and college students and professional members who are enrolled in technical, skilled, and service occupations.